SECTION III. FORECASTS.

FORECASTS AND WARNINGS, JUNE, 1918.

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PRESSURE OVER THE PACIFIC AND ALASKA.

Pressure at Honolulu has been uniformly below the normal since the 1st of April. At Midway Island also it has been below the normal except for short periods. Thus, in June, pressure at Midway was above normal from the 8th to the 12th and from the 21st to the 23d.

Pressure in Alaska during June was mostly above the normal except for two short periods of low pressure corresponding roughly to the periods of high pressure at Midway Island, given above. The low pressure at Honolulu was the subject of some comment by the present writer in the April REVIEW **46**:182. Since that time he has had an opportunity to examine the previous records of monthly mean pressure at Honolulu and to attempt to correlate them with weather in the United States. The attempt was not successful in reaching definite conclusions or, indeed, in establishing any relation between the pressure at Honolulu and subsequent weather in the United States. A record of 27 years of monthly mean pressures is available for Honolulu, and it would seem that a correlation of the monthly departures from the normal with similar data for points in the United States would yield useful data. Dot charts have been made to show the relation between April departures at Honolulu and departures for the same month at several points in the United States. Similar charts have been made also for April at Honolulu and the subsequent months of May, June, and July in the United States in the expectation that perhaps a drifting eastward of the pressure abnormalities might appear. There was much scattering on the dot charts and there did not seem to be any definite relation between the two events.

Arctowski [1] has shown that pressure abnormalities in the United States progress from East to West. His studies, however, refer to annual abnormalities.

In order to determine whether the monthly abnormalities of pressure show a similar progression, I have charted them for the eight months, October, 1917, to May, 1918. The monthly departures from the normal pressure are regularly published in Table 1 of the MONTHLY WEATHER REVIEW and these values have been used. The chart for October, 1917, shows that pressure for that month was below the normal in the Lake region and thence eastward to the Atlantic, including the Ohio Valley; and that it was above normal in the South and West with the peak of the excess in the northern Rocky Mountain and Plateau regions and the States of Washington and Oregon. In the succeeding month of November, pressure was everywhere above normal except along the New England coast and at Hatteras, N. C. The peak of the excess was found in the upper Lake region—a distinct eastward movement as compared with October. It is interesting to note that pressure was above the average in November in those districts in which the excess in October was most marked. In the third month of the comparison, December, 1917, the peak of the HIGH was in Minnesota and North Dakota with a second peak in upper Michigan and the excess was somewhat greater than in the preceding months. While the peak of the December HIGH is slightly westward of its position in the preceding month, there is still a very noticeable eastward movement of the area of excess of pressure. As a whole, the December chart also shows a small area, including Wyoming, Idaho, western Montana, eastern Washington, and eastern Oregon, of pressure below the normal.

In the January, 1918, chart this region of deficient pressure has apparently spread eastward and southward to include practically the entire country; but, curiously, the districts of greatest deficit are along the Atlantic coast from Hatteras to Eastport, rather than over the western interior where naturally it would be expected. Pressure was above the normal for the fourth consecutive month in the Pacific Coast States except in southern California.

During February, 1918, the distribution of pressure abnormalities changed. Hitherto the line of zero change had a N-S direction. On the February, March, and April charts the line of zero change has an E-W direction. In February pressure was above the normal in the north and below the normal in the south. In March these conditions were reversed, although the magnitude of the departures was not great in any part of the country. In April the seesaw continued. In this month pressure in the northern part of the United States was above the normal and in the southern part below the normal, although, as before, the magnitude of the abnormalities was not great.

In May, 1918, the region of deficient pressure was confined to the States of Montana, Wyoming, Colorado, Utah, New Mexico, eastern Nevada, Kansas, Nebraska, the Dakotas, Iowa, Minnesota, and Wisconsin, and the region of excess pressure to the remainder of the country with the peak of the excess (+0.15 inch) in the southern Appalachian region. Thus we see that the pressure abnormalities computed for monthly periods have a progressive movement toward the east in the cold season, and during the spring months appear to seesaw between a north and a south direction.

Of course, definite results can not be established from eight months' records, but enough has been shown to warrant further effort along the same lines. The goal is, of course, the possibility of determining seasonal weather conditions from pressure abnormalities. The unseasonable cold of the winter of 1917–18 was preceded, as we have just seen, by a marked increase in pressure over the northwestern States, and this increase was maintained farther eastward during the succeeding months of November and December. It is true that change from high to low pressure was first shown in the monthly abnormalities for the extreme northwest for December, 1917, but the January, 1918, chart of abnormalities conveys the very distinct impression that the development of low pressure over the western North Atlantic was independent of the depression of the barometer in the Northwest of the preceding month. The apparent explanation is that LOWS, after reaching the Atlantic coast, increased in intensity and thus caused a greater deficit in pressure over the coast regions than at points to the westward.

Comparing the charts of abnormal pressure distribution with chart IV of the MONTHLY WEATHER REVIEW,

[1] Bulletin American Geographical Soc 42: 273, 1910.

"Departures of mean temperature from the normal," we note the following:

October, 1917: The region of greatest negative temperature departure is considerably to the eastward of the corresponding area of greatest positive pressure departure.

November, 1917: The area of greatest positive temperature departure (15° F.) is almost coincident with the area of greatest positive pressure departure, whereas the area of negative temperature departure coincides with a region of small positive pressure departures. The evidence of this month is contrary to the idea that positive pressure departures are coincident with negative temperature departures, but in the succeeding month of December, 1917, there is a complete reversal of the November conditions; pressure was almost everywhere above the normal and temperature east of the Rocky Mountains was below the normal. West of the Rockies, however, both pressure and temperature were above the normal.

In January, 1918, the pressure departures were practically the reverse of those which obtained in December, 1917, but the temperature abnormalities were almost identical with those of the previous month. Further comparison seems to show that the relation between abnormalities of temperature and pressure is not a direct and simple one.

The current month was characterized by low pressure in the southern part of the United States, the Gulf and Caribbean regions, and the western portion of the North Atlantic.

Temperature was exceptionally high, mainly in the Southwest, and west of the Rocky Mountains, although high temperatures also prevailed in the middle Misssissippi and lower Ohio valleys and along the Gulf coast. In northeastern districts the month was relatively cool and dry and in general the precipitation was below the normal.

PRESSURE ABNORMALITIES AND SUNSPOT MINIMA.

Returning now to the subject of Pressure Abnormalities it is to be noted that an inspection of the numerical values of monthly pressure departures at Honolulu for the 22 years, 1895–1917, shows a very striking period of deficient pressure centered about the sunspot minima of 1901.7. The April monthly departures for the period are as follows:

Month.	Departure.
April, 1899	−0.06
April, 1900	−0.07
April, 1901	−0.07
April, 1902	−0.05
April, 1903	−0.07

Departures of equal magnitude were experienced in practically every month of the four years 1899–1902, the greatest departure in any month being −0.18 in February, 1901, a month of severe weather in Hawaii with snow in the mountains.

Negative departures in the monthly mean pressure at stations in the southern part of the United States were also recorded during the four years above mentioned; but the magnitude of the departure was not so great, nor were the departures so continuous from month to month, as at Honolulu.

The period covered by the negative departures at stations in the United States varied also from point to point. Thus, it began at San Diego, Cal., in 1897, two years before it began at Honolulu; while at Key West, Fla., the beginning was deferred to 1902—a year after the epoch of minimum spottedness, and three years after diminished pressure was manifest at Honolulu.

Passing now to the next epoch of sunspot minima, viz, 1913–14, it is to be noted that while the tendency is toward negative pressure departures, both their magnitude and uniformity are much less than during the epoch 1901.7.

Daily reports received at the Washington Office in June 1918, showed the existence of abnormally low pressure over the western Caribbean region as well as along the Gulf Coast and over Florida. By reference to reports for April and May, 1918, it is found that pressure was also low in these months; therefore what was at first supposed to be a local depression of the barometer at Honolulu was really an extensive depression of the barometer probably extending in an E/W direction over at least a quarter of the earth's circumference.

THE WEATHER OF THE MONTH.

It is difficult to define just what definite control, if any, was exercised by the diminished pressure in subtropical regions as indicated in the preceding paragraph. We can, however, point out the abnormal features of the weather in the United States, leaving to the future any adjustment as to cause and effect that may be possible. As a whole the month was dry except in the State of Iowa and in a limited region adjacent thereto. Showers fell in Iowa almost daily, seemingly without much regard to the pressure distribution except that the border zone between low pressure to the southwest and higher pressure to the northeast passed through that State. The temperature distribution was marked by high values in the Rocky Mountain and Plateau Regions and the southwest, including in the last expression Oklahoma, Texas, New Mexico, Arizona, and Nevada. At the same time the temperature in northeastern districts was unseasonably low the greater part of the month. During the second decade the highest June temperatures of record were registered at a number of stations in the southwest, some of which have a series of observations extending upward of 40 years. Unusually high temperatures were also registered along the Gulf coast, in Missouri, Iowa, the lower Ohio valley, and the northern Rocky Mountain Region.

In a general way, the run of the LOWS in June was along the northern boundary, but almost without exception they were lacking in intensity and showed a tendency to move toward Hudson Bay. The HIGHS, on the contrary, were unusually vigorous for the season, and several of them passed entirely across the country. The place of origin seems to have been about equally divided between the North Pacific and the interior of the Canadian northwest. It seems reasonable to attribute the unusual activity of the HIGHS to existing low pressure both in extratropical regions and over the western North Atlantic off the South Atlantic coast.

HIGHS.

Nine principal and one secondary HIGH have been plotted, of which four apparently originated over the Pacific off the British Columbia northwest. In only three of these did the barometer level reach and pass above 30.30 inches. HIGH No. 8, originating in Alberta on the 20th, was attended by frost in the lowlands of Michigan and Indiana on the morning of the 23d. This HIGH attained its greatest intensity in the morning of

the 21st over northern Manitoba. After passing within the United States it diminished in intensity, and on the 24th had practically disappeared. Frost did not occur in other sections of the Northwest, but in the States named the sky cleared and the wind fell on the night of the 22–23d, thus realizing ideal conditions for the occurrence of frost even though the barometric conditions were not decisive.

LOWS.

Ten primary and three secondary LOWS have been plotted. The great majority of the primary LOWS were of the Alberta type. LOW No. 1, while grouped with the primary LOWS, persisted but 36 hours. Its influence was appreciable over eastern districts, although the surface pressure gave no indication of a cyclonic circulation.

The movement of LOW No. 9 is uncertain over that portion of its path represented by a dashed line. Pressure had been low over the Southwest for several days before the LOW in question began a movement toward the northeast. The immediate cause of its movement appears to have been the southward sweep of HIGH No. 9.

STORM WARNINGS.

Storm warnings were issued for the Great Lakes on the 1st, 11th, and 28th. The warnings on the last-named date were only partially verified.

Storm warnings were issued for the Atlantic coast, Delaware Breakwater to Eastport, on three occasions, viz, on the 11th, 21st, and 26th. On the 11th a deep depression passing down the St. Lawrence Valley was the cause of fresh to strong westerly winds along the coast on the 12th. On the 21st it was anticipated that a depression over the Great Lakes would develop in intensity as it approached the coast. Strong southerly winds were experienced on the coast of Southern New England on the 22d and on the Maine coast on the morning of the 23d.

The third display of storm warnings on the Atlantic coast was occasioned by the presence of a moderate disturbance over Cape Hatteras the morning of the 26th. This disturbance caused moderate easterly gales off the Virginia coast, but there was no wind of consequence along the New Jersey coast since the storm moved off to sea instead of northeastward along the coast.

FROST WARNINGS.

Warnings of light frost were issued for the cranberry bogs of New Jersey on the 8th, 15th, 19th, 20th, and 23d. The warnings of the 8th and 20th were followed by light frost in the bogs; that of the 15th was followed by a minimum temperature of 28°, and those of the 19th and 23d were failures. A general failure of light frost warnings for the Middle Atlantic and New England States on the 23d is to be noted. The temperature in these States on the morning of that date was 15 to 20° below the seasonal average and the weather was cloudy with anticyclone conditions advancing from the west. The failure of the anticyclone to continue in its eastward movement seems to be the explanation of the failure in the frost forecasts.

WARNINGS FROM OTHER DISTRICTS.

Chicago, Ill., forecast district.—No warnings of a general character were issued at any time during the month, special advices being limited to local frost warnings. On June 6 warnings of frost were sent to the cranberry marshes of Wisconsin, and a minimum of 27° was reported the next morning on the bog at Beaver Brook. The temperature at the other stations did not fall to freezing. Moreover, light frost occurred without warnings at Beaver Brook on June 22 and at Berlin on June 23, but the temperature was not low enough to cause any damage.—*H. J. Cox, District Forecaster.*

New Orleans, La., forecast district.—Warm weather for June prevailed generally over the district, and temperature changes were, as a rule, slight. Precipitation was unevenly distributed, being above the normal over the northern, and below the normal in most localities over the southern portion of the district.

No storm warnings were issued and no general storm occurred during the month.—*I. M. Cline, District Forecaster.*

Denver, Colo., forecast district.—The warnings issued were confined to frost warnings in high districts in northern Utah on the 1st and advices of moderate to fresh and possibly strong winds for portions of New Mexico, Arizona and Utah on a few dates in the latter part of the month. At regular stations fresh to strong winds occurred as follows: At El Paso on the 21st, 28 miles per hour from the southeast; at Salt Lake City on the 15th, 36 miles from the southwest. Advices of fresh to strong southerly winds were issued for both of these dates.—*Frederick W. Brist, Assistant Forecaster.*

San Francisco forecast district.—June, 1918, was unusually quiet in the San Francisco District. Temperatures averaged unusually high, except along the immediate coast. Rainfall in portions of Nevada and extreme southern California was slightly above normal, but in the principal agricultural sections of the district there was a marked deficiency. No storm, fire-weather, or other special warnings were issued, nor were they needed. The weather charts on June 8, 9, 10, 11, 12, and 13 illustrate the successive steps that take place in the formation of an elongated trough-shaped barometric depression, which originates over southern California and later projects northward and joins a low-pressure area of slight energy over British Columbia. During the early days of the formation temperatures gradually increase, and on the third or fourth day the trough-shaped barometric depression breaks up into several small low-pressure areas, which are characteristic of an unstable atmospheric condition. During the evolution of the formation sporadic electrical storms occur in the mountain sections of the district, which on successive days become more and more numerous. They reach their maximum when the trough-shaped depression breaks up into eddies, and a day or two afterward the entire disturbance advances eastward and conditions in this district become normal. The electrical storms attending the phenomenon just described caused numerous forest fires in this district during the current month, most of which were easily extinguished; but some got beyond control, and were causing considerable trouble at the end of the month. Fortunately no very high winds occurred, and the fires had not become large enough to cause serious doubts as to their ultimate control should the weather continue quiet. On account of the great deficiency in precipitation and the general excess in temperature since the first of the year, the forest undergrowth is unusually dry, and with normal conditions during July and August there will be many unpreventable fires started by lightning. Therefore every precautionary measure possible should be taken against the starting of preventable fires.—*E. A. Beals, District Forecaster.*